B. Claims

The listing of all claims in the application is provided.

 (Original) A processing method for forming an insulated film on a surface of a substrate to be processed, through an oxynitriding treatment, said processing method comprising the steps of:

nitriding a surface of the substrate by irradiating plasma containing nitrogen atoms onto the substrate; and

oxidizing the surface of the substrate, which has been nitrided, by irradiating plasma containing oxygen atoms.

- 2. (Original) A processing method according to claim 1, wherein said nitriding and oxidizing steps place the substrate on a susceptor, a temperature of the susceptor being maintained at 600 °C or lower.
- 3. (Original) A processing method according to claim 1, wherein said substrate include silicon, and said nitriding and oxidizing steps control a process time so that the insulated film has an effective oxide thickness of 3.0 nm or smaller.
- 4. (Original) A processing method according to claim 1, wherein said nitriding step uses, as process gas, gas that includes at least one of N_2 , NH_3 and N_2H_4 or the one which is diluted with at least one of He, Ne, Ar, Kr and Xe, mixed gas of $H_2 + N_2$ or the one which is diluted with at least one of He, Ne, Ar, Kr and Xe.

- 5. (Original) A processing method according to claim 1, wherein said oxidizing step gas uses, as process gas, gas that includes at least one of O_2 , O_3 , H_2O , and H_2O_2 or the one which is diluted with at least one of He, Ne, Ar, Kr, Xe and N_2 .
- 6. (Original) A processing method according to claim 1, wherein said oxidizing step sets ion energy to be 5 eV or smaller incident to the substrate from the plasma.
- 7. (Original) A processing method according to claim 1, wherein said substrate includes silicon, and said oxidizing step controls an oxygen atom concentration so that a nitrogen atom concentration is 5 % or smaller at a position near an interface between the silicon and a silicon oxynitride film in the insulated film.
- 8. (Original) A processing method according to claim 1, wherein said nitriding step controls a process time so that the insulated film contains the nitrogen atoms between 3×10^{14} cm⁻² and 1.5×10^{15} cm⁻² that is converted into a surface density.